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ENDURANCE TESTING OF TRACKED AND WHEELED VEHICLES

U.S. Army Test and Evaluation Command  
Aberdeen Proving Ground, Maryland

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US ARMY TEST AND EVALUATION COMMAND  
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-101  
\*Test Operations Procedure 2-2-506  
AD No.

26 June 1981

ENDURANCE TESTING OF TRACKED AND WHEELED VEHICLES

	<u>Page</u>
Paragraph 1. SCOPE . . . . .	1
2. FACILITIES AND INSTRUMENTATION. . . . .	2
3. PREPARATION FOR TEST. . . . .	3
3.1 Test Planning. . . . .	3
3.2 Facilities. . . . .	3
3.3 Test Item . . . . .	3
3.4 Instrumentation . . . . .	3
3.5 Test Personnel. . . . .	4
3.6 Safety and Health Evaluation. . . . .	4
4. TEST CONTROLS . . . . .	4
5. ENDURANCE TEST. . . . .	5
5.1 Method. . . . .	5
5.1.1 Course Speeds . . . . .	5
5.1.2 Towed Loads . . . . .	5
5.1.3 Maintenance and Inspections . . . . .	5
5.1.4 Spectrometric Oil Analysis. . . . .	6
5.1.5 Modifications . . . . .	6
5.1.6 Special Tests . . . . .	6
5.1.7 Final Inspection. . . . .	6
5.2 Data Required . . . . .	6
6. DATA REDUCTION AND PRESENTATION . . . . .	7
APPENDIX A. USE OF THE TACHOGRAPH . . . . .	A-1
B. TRACKED VEHICLE GROUPS, SCHEDULES, AND REQUIREMENTS. . . . .	B-1
C. WHEELED VEHICLE GROUPS, SCHEDULES, AND REQUIREMENTS. . . . .	C-1
D. DATA COLLECTION SHEETS. . . . .	D-1

1. SCOPE. This TOP establishes procedures for conducting endurance tests of military tracked and wheeled vehicles over various standard test courses for a prescribed number of kilometers, miles, or hours. Both land and water courses are included. The TOP provides for participation by military test and evaluation personnel in selected phases of development tests. These phases are intended to produce data on the reliability, availability, maintainability, and human engineering of test vehicles when operated and maintained by personnel with skill, training, and experience levels that are representative of those of the expected field users.

An endurance test is a test which involves extended operation of one or more test items under cycles designed to simulate, under proving ground conditions, extended field use. The endurance test is the principal means of producing data for reliability and availability during development tests, and also is a major source of information on maintainability and human factors.

✓ This TOP supersedes TOP 2-2-506, 9 September 1976.

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26 June 1981

A durability test, on the other hand, relates to the mathematical probability that a vehicle or a major component thereof will be able to operate under defined conditions for a specified number of kilometers, miles, or hours before requiring major overhaul, replacement, or salvage. The test cycles prescribed in this TOP for endurance testing may constitute a major portion of a durability test conducted in accordance with TOP 1-2-502. A complete durability evaluation is seldom performed on developmental vehicles since large sample sizes, extensive test mileage, and considerable funding are required.

## 2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities. Select appropriate test courses to satisfy the test directive from those described in TOP 1-1-011. Equivalent courses may be used.

### 2.2 Instrumentation.

<u>ITEM</u>	<u>MAXIMUM PERMISSIBLE ERROR OF MEASUREMENT*</u>
Recording tachograph (Described in Appendix A)	Vehicle speed: At 16 km/hr, $\pm 3$ km/hr; 48 km/hr, $\pm 5$ km/hr; 97 km/hr, $\pm 5$ km/hr Distance: $-1\%$ to $+3.75\%$ for travel at 72 km/hr Time: $\pm 10$ minutes in 24 hours Rpm: 500 - 3000 rpm, $\pm 50$ rpm
Motion picture or still camera	Used for recording test anomalies only
Direct reading emission spectrometer	Contaminant concentrations to within $\pm 2$ ppm or $\pm 15\%$ of reading, whichever is larger, in the oil
Meteorological equipment	
Temperature	$-35^{\circ}$ to $+50^{\circ}\text{C}$ , $\pm 0.2^{\circ}\text{C}$
Relative humidity	5% to 100% RH, $\pm 1\%$
Wind speed	0 to 45 m/s, $\pm 0.8$ m/s

\*Values may be assumed to represent  $\pm 2$  standard deviations; thus the stated tolerances should not be exceeded in more than 1 measurement out of 20.

### 3. PREPARATION FOR TEST

3.1 Test Planning. Establish an endurance subtest and a logistic supportability subtest. The former defines the courses to cover, the mileage, the sequence of operations, and the data to obtain; and provides the data for the latter subtest. (See Paragraph 5.2.)

3.2 Facilities. Identify the test courses used in the test by name, location, and description. Include details such as type of soil, course contour, length and degree of grades, course length, description of surface roughness, season of year, and wetness of course. If a profilometer is available, also present the course description in terms of power spectral density as described in TOP 1-1-010.

#### 3.3 Test Item.

3.3.1 Initial Inspection and Lubrication. Initially inspect and lubricate the test item to ensure that all components function satisfactorily (TOP 2-2-505). The inspection usually is limited to visual and functional inspection of the test item but can be expanded to include more details when doubt exists concerning the serviceability of the test vehicle. Record the model and serial numbers of the vehicle and major components. Check lubricant types against specifications and record deviations. This information is particularly significant for experimental or foreign vehicles since little is known of the material used for seals and bearings. Spectrometric analysis of the initial lubricants (TOP 2-2-701) may help to identify the type used and provide baseline data for future spectrometric analysis for contaminants. Perform maintenance and service operations to insure that the vehicle is in condition for optimum performance. Give particular attention to engine, transmission and running gear.

3.3.2 Break-In Operation. Operate new vehicles for the appropriate break-in mileage as described in TOP 2-2-505. The break-in phase of the test program provides an opportunity for driver training and familiarization with the test item. The break-in operation also is intended to identify most "infant mortality" failures from the reliability data. During this operation, use the vehicle and engine speeds recommended by the manufacturer when they are more restrictive than those shown in TOP 2-2-505. When necessary, adjust engine governors for recommended crankshaft speeds. Operate the vehicle under mild conditions with minimum load.

3.3.3 Test Loads. Unless otherwise specified, load each vehicle with the cargo or simulated payload it is designed to carry. A dump truck hauls gravel, sand, or crushed stone, whereas a cargo carrier is loaded with 55-gallon drums, simulated ammunition, or component parts in boxes. Load tanks with dummy ammunition and load personnel carriers with weights to simulate crew. Materials are selected for simulated loads which will neither strengthen nor weaken the test vehicle structure artificially. Secure loads adequately to prevent shifting, and instruct the drivers concerning special hazards.

3.4 Instrumentation. Mount recording instrumentation (e.g., Appendix A) on each test vehicle to record vehicle speed, engine speed, engine hours, and critical temperatures and pressures.

3.5 Test Personnel. Select an appropriate number of test drivers at random from a pool of qualified drivers based upon the miles to be driven, the number of test vehicles, and the number of experienced drivers available. For test phases employing military operators, select the drivers based on the degree to which they represent the field users of the test vehicle in terms of age, rank or grade, size, driving experience, and specialized military training.

Train appropriate personnel in the operation and maintenance of the test item utilizing the pertinent technical manuals or other appropriate documents. Guidance for operator training and familiarization is contained in TOP/MTP 10-2-501.

3.6 Safety and Health Evaluation. Before starting an endurance test, conduct those tests necessary to establish a reasonable assurance that the test item can be tested with a minimum risk to personnel. TOP 2-2-508 should be consulted for a description of those tests that may be required to adequately evaluate safety and health aspects of the test vehicle. The results of the safety and health evaluation are used as a basis for the test activity to recommend that TECOM issue a safety release (DARCOM Regulation 385-12 with TECOM Supplement 1 1). Military and civilian testing subsequent to the safety and health evaluation must abide by the controls or limitations that may be imposed by the safety release issued by TECOM.

3.7 Data Required. Record the following data during preparation for test:

- a. Test course identification and description.
- b. Vehicle and major component serial numbers.
- c. Applicable track data, payload weight and configuration, break-in mileage, and any post break-in adjustments.
- d. Driver's name.

4. TEST CONTROLS.

- a. Observe all safety SOP's throughout test operations.
- b. Maintain correct levels of standard military lubricants, hydraulic fluids, coolant, etc., in the test vehicle.
- c. Use referee grade fuels in vehicles that normally require combat fuel to simulate the marginal-quality fuel that would be available in time of a national emergency. (See TOP 2-2-701.)
- d. Record condition of sky (clear, cloudy), temperature, relative humidity, and general weather conditions (rain, muddy, snow, etc.) for all periods of operation.

1/ DARCOM-R 385-12 and TECOM Supplement 1, Life Cycle Verification of Materiel Safety.

e. To limit the influence of individual driving habits on test results, rotate the drivers among test vehicles according to a predetermined schedule so that each of three to five drivers will operate each vehicle for a comparable proportion of the total test mileage for each course.

f. Maintain the severity level of the courses as constant as possible throughout testing using the procedures described in TOP 1-1-010.

g. Conduct half of the test with the turret at 6 o'clock, and the other half at 12 o'clock.

h. If possible, conduct the test under conditions comparable to all four seasons of the year.

## 5. ENDURANCE TEST.

5.1 Method. Operate the test vehicles as described below over the appropriate courses for the distances indicated in Appendix B, Tracked Vehicles or Appendix C, Wheeled Vehicles (unless other schedules are specified in the requirements documents). The mileage is accumulated in cyclic increments of primary, secondary, and cross-country operations until the total mileage is reached. These appendixes define the types of military vehicles which are grouped for the purpose of endurance testing and include sample mileage schedules and additional test requirements appropriate for development and production tests of each vehicle group. For tests of reconditioned or modified standard vehicles, abbreviated versions of these schedules may be selected by test sponsors based on the objectives of the specific program. Use military operators to accumulate a portion of the scheduled mileage as established during test planning.

5.1.1 Course Speeds. Maintain reasonable and practical speeds for the particular course conditions consistent with safety requirements.

5.1.2 Towed Loads. Each vehicle tows its designated towed load for at least 50 percent of all test operations unless otherwise specified. Both towing and towed vehicles carry their rated payloads and any allowable overload determined by special tests.

5.1.3 Maintenance and Inspections. Perform preventive (scheduled) maintenance as prescribed in the applicable technical manual; perform corrective (unscheduled) maintenance as required to keep the vehicle operational. Soldier maintainers perform the organizational level maintenance functions as required during operation and testing by military test and evaluation personnel, and may participate in direct and general support maintenance as necessary. Observe the operator's daily checks and services to obtain a representative time to perform the tasks. Record all maintenance action data pertinent to reliability, availability, and maintainability (RAM) parameters including scheduled and unscheduled maintenance time in man-hours and clock-hours. Inspect the vehicle at least once during each 8 hours of operation for deficiencies, damage, or unusual wear.

5.1.4 Spectrometric Oil Analysis. When the compatibility of fuels and lubricants with the test vehicle is to be evaluated, take lubricant samples during the test for a spectrometric oil analysis in accordance with TOP 2-2-701.

5.1.5 Modifications. Incorporate engineering modifications as required to eliminate causes of damage or undue wear to the vehicle as soon as practicable. Obtain the concurrence of the design agency or TECOM in the case of DT I, II, and III tests before applying or installing any modification.

5.1.6 Special Tests. When required, conduct special tests on specific components during the endurance runs such as headlight tests, engine or transmission tests, etc. Noise tests (TOP 1-2-608) should be considered near the beginning and the end of the endurance test.

5.1.7 Final Inspection. After the mileage tests, disassemble the vehicles to the extent required for visual and dimensional inspections of unusual wear or damage to components. Record the results using photographs to show the wear and condition of major components.

5.2 Data Required. Insofar as practicable, collect test data on a continuing basis using standard forms. Figure 3 (Appendix D) shows a typical test log for recording events and distance over the various courses. Document all test incidents by Equipment Performance Report (EPR) in accordance with DARCOM-R 700-38 and TECOM Supplement 1. <sup>2/</sup> Collect maintenance data (i.e., logistic supportability data) using the appropriate forms of TECOM Supplement 1 to DARCOM-R 700-15 <sup>3/</sup>; namely, the Supportability Analysis Chart, Supply Support Chart, Technical Data/Equipment Publications Chart, and Support and Test Equipment Chart.

If data are to be processed by ADP, use the data recording system required by the directive, which may be either the TAIDB (Tank-Automotive Integrated Data Base) system of the CTDCS (Common Test Data Collection System <sup>4/</sup>). If no system is specified, use the APG system <sup>5/</sup>. This system uses the forms shown in Figures 4 through 8, Appendix D.

Record the following, as applicable, using the above data collection forms where appropriate:

- a. Initial and final odometer reading and miles traveled.
- b. Vehicle speed record and average speed each course.

<sup>2/</sup> DARCOM-R 700-38 and TECOM Supplement 1, Test and Evaluation - Incidents Disclosed During Materiel Testing.

<sup>3/</sup> DARCOM-R 700-15 and TECOM Supplement 1, Integrated Logistic Support, 20 June 1980.

<sup>4/</sup> DARCOM Pamphlet XXXX, Common Test Data Collection System (Expected Date of Publication - 1981).

<sup>5/</sup> Belleville, Robert L., Special Study of Automation and Maintainability Data Collecting and Reporting Procedures, Aberdeen Proving Ground, MD, Report No. APG-MT-3860, June 1971.



- c. Engine total running time and total idling time.
- d. Component operational hours.
- e. Vehicle fuel consumption (TOP 2-2-603).
- f. Quantity and type of engine oil, lubricants, and coolant used.
- g. Component failures and failure analysis.
- h. Parts mortality data.
- i. Required component adjustments.
- j. Conditions such as road, weather, etc., affecting vehicle performance.
- k. Reliability and maintainability data for all DT I, II, and III tests, and customer tests as specified. Provide all of the information required by the forms contained in AR 750-1 and TECOM Supplement 1 for each maintenance action such as odometer reading, vehicle hours, man-hours, maintenance level, part failure, scheduled/unscheduled, men involved, action required, etc.
- l. Human factors observations. (All information required by TECOM Supplement 1 to AR 602-1).
- m. Data on component tests (as required by the applicable specification and the test directive).
- n. Results of spectrometric oil analysis.
- o. Tire wear data (see TOP 2-2-704) for those wheeled vehicles following the schedules of Table 5.
- p. Data on additional requirements for applicable vehicle group.
- q. Results of final inspection.
- r. Any safety hazards noted.

6. DATA REDUCTION AND PRESENTATION.

- a. Summarize all data to identify significant deficiencies and shortcomings and overall fuel and lubricant consumption. Show fuel consumption on individual test courses for different vehicle configurations and course conditions when required.
- b. Present data of Paragraph 5 in graphical and tabular form.

26 June 1981

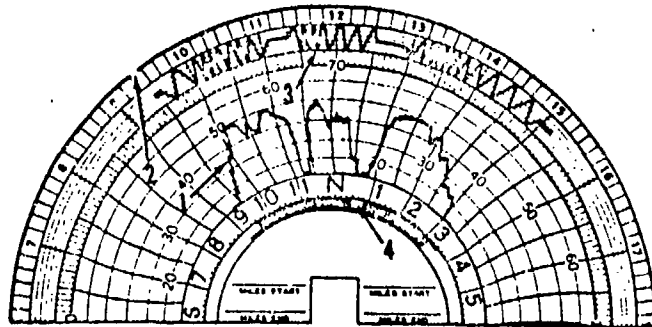
c. Prepare charts and graphs to show operation versus maintenance time, component failures, parts mortality, etc. (For guidance in calculating and presenting maintenance data see AR 750-1 and TECOM Supplement 1.) When ADP is used, most of the RAM parameters are automatically computed at any point during the course of the test program. ADP will, in addition, produce graphical displays of reliability, accumulated failures, availability, accumulated vehicle hours, maintenance ratio, and accumulated man-hours, all versus test miles or kilometers.

d. Carefully analyze the adequacy of modifications made to the vehicle since modifications in most cases are incorporated during the course of testing and will not undergo the full vehicle test mileage. In the case of critical modifications or those installed late in the test program it may be necessary to recommend that additional tests or a retest be conducted to determine whether the modifications are suitable.

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APPENDIX A  
USE OF THE TACHOGRAPH

1. A tachograph is a device for recording speed, mileage, and operating time of a vehicle. The mechanical tachograph used in endurance tests of tracked vehicles records the data by styli on either a 12- or 24-hour circular chart as shown in figure 1.



All mile-per-hour charts<sup>a</sup> record four separate operations, each coinciding with the exact time of day or night: (1) speed of the vehicle, (2) opening or closing of the tachograph door, (3) number of miles traveled, (4) engine operation.

Figure 1. Record-of-Operation Chart.

2. The tachograph is normally mounted to the instrument panel of the vehicle and connected to the speedometer cable. To permit the use of both the speedometer/odometer and the tachograph, a dual-drive adapter is used. The tachograph is also attached to an electrical source (one wire connected between the engine side of the ignition switch and the middle connection screw of the vehicle's dashlight circuit) to operate the speed signal light and the light that illuminates the clock and speed dial. The clock is handwound to start the operation of the tachograph. Vehicles that have a two-speed rear axle or have diesel engines without an ignition switch require additional specialized installation. Tachographs should be checked for accuracy in accordance with the instructions of the manufacturer.

3. A chart analyzer (fig. 2) is used to simplify the addition of total idle time over the course of the trip recorded.

<sup>a</sup>Charts also available in kilometers per hour.

26 June 1981

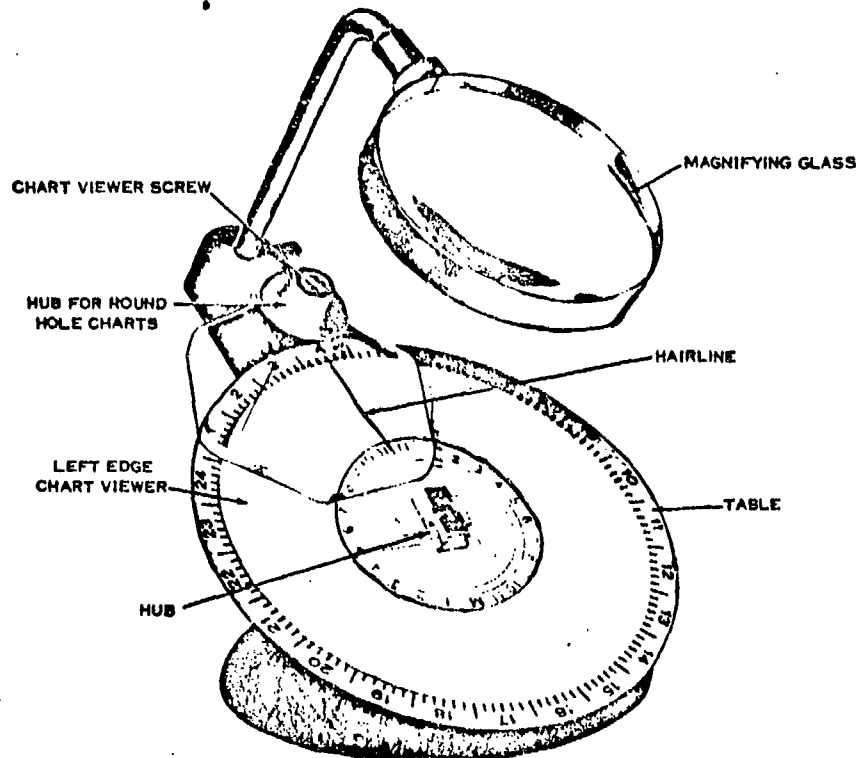


Figure 2. Tachograph Chart Analyzer.

4. The manufacturer's installation and operating instructions should be consulted for detailed information on the use of the tachograph.

5. An electrical tachograph 5/ - which has certain advantages including increased flexibility, the elimination of torque load on the vehicle's speedometer/odometer, and the ability to record engine speed - has been under consideration and is expected to be developed and used in the future. It records on magnetic tape. A vehicle performance recorder, 6/ also employing magnetic tape, is being developed. This device is expected to be more sophisticated than the tachograph and able to record additional vehicle parameters; e.g., radiator temperature.

5/ Cannon, William H., III, Special Study of Applications of Electrical Tachographs to Automotive Vehicle Testing, Aberdeen Proving Ground, Md., Report APG-MT-4067, May 1972 (TECOM Project 9-CO-001-000-045).

6/ TECOM Project 9-CO-081-000-008, Vehicle Performance Recorder, Materiel Testing Directorate, Aberdeen Proving Ground, Md.

APPENDIX B  
TRACKED VEHICLE GROUPS, SCHEDULES, AND REQUIREMENTS

Table 1 - Tracked Vehicle Endurance Test Mileage Schedule\*

<u>Terrain Type</u>	<u>Distance per Cycle - Km</u>		
	<u>Cat. 1</u>	<u>Cat. 2</u>	<u>Cat. 3</u>
Level Paved Road	460 (23%)	540 (27%)	320 (16%)
Secondary Road	500 (25%)	620 (31%)	440 (22%)
Belgian Block	40 ( 2%)	40 ( 2%)	40 ( 2%)
	1000 (50%)	1200 (60%)	800 (40%)
Hilly Cross-country	500 (25%)	400 (20%)	600 (30%)
Level Cross-country	500 (25%)	400 (20%)	600 (30%)
	1000 (50%)	800 (40%)	1200 (60%)

\*The standard endurance test covers 10,000 km, composed of 5 cycles of 2000 km each. See Table 2 for other required actions.

Tracked Vehicle Categories

Cat. 1 - Tracked vehicles that normally use roads and cross-country equally. Examples: Main battle tanks and other vehicles (such as armored personnel carriers; reconnaissance, scout and assault vehicles; maintenance vehicles; cargo carriers; prime movers; and missile ground-support vehicles; engineer assault vehicles) required to operate under the same conditions.

Cat. 2 - Tracked vehicles that normally use roads more often. Examples: Recovery vehicles, command post vehicles, self-propelled artillery.

Cat. 3 - Tracked vehicles that normally use roads less often. Example: Airborne light tank.

Cat. 4 - Special cases. Examples: Amphibious vehicles, engineer crawler trackers.

Table 2 - Other Testing during Endurance Test of Tracked Vehicles

Weapon Firing - For vehicles with weapons, fire main and supplementary weapon systems during endurance tests. Frequency of firing is listed in criteria or mission profile for the weapon system and must be integrated into the test. This testing will include fire control, ammunition loading, and tests of other associated equipment.

Towed Loads - Run one-half of total mileage with applicable towed load (except for cargo tractors that have towed load 100% of operation).

Amphibious Operations - Include approximately 2-1/2 hours of water operation per cycle to total 10 hours for vehicles with amphibious capability. For amphibious vehicles (LVT type) include 25 hours of water operation until 100 hours have been accumulated.

Mission Functions - Perform all mission functions periodically in accordance with mission profile and operational mode summary. Make functional checks of all systems after appropriate intervals (not to exceed 8 hours) of mission function operating hours.

APPENDIX C  
WHEELED VEHICLE GROUPS, SCHEDULES, AND REQUIREMENTS

Table 4 - Description of Wheeled Vehicle Categories

Group	Description
W1	General and special purpose military trucks used for transporting personnel, cargo, and equipment in operations involving high mileage. Typical vehicles include cargo and utility trucks, armored cars, and special transporters.
	Specialized bodies and equipment on group W1 chassis are tested in accordance with the group W2 procedure.
W2	Truck bodies on group W1 chassis but having specially designed equipment. Typical vehicles include field ambulances, wreckers, crane and dump trucks, cargo van trucks, maintenance and test shops, fire control and electronic units, expansible vans, and other trucks used primarily for housing technical equipment for support of tactical units rather than for general transport purposes.
W3	Lightweight, low-mileage vehicles having little or no springing and a minimum of seating accommodations or other components not essential to operation.
W4	All terrain-type vehicles specially designed for traversing marshy terrain, snow, and sand. Included are vehicles having pneumatic rollers or other high-flotation components.
W5	Special purpose wheeled vehicles intended primarily for amphibious operations. These vehicles may incorporate hull and marine components applied to a standard chassis or may have hull and chassis of special design stressing marine characteristics.
W6	Vehicles designed for fire fighting. Such vehicles may have special equipment on a standard, general purpose chassis, or they may be for a special purpose and have a special chassis.
W7	Commercial vehicles such as passenger cars, light and medium trucks, and buses.

Table 4 - (Continued)

Group	Description
W8	<p>Military truck-tractors and semitrailers. The truck-tractors usually consist of a group W1 truck chassis with a fifth wheel mounted on the frame for coupling of semitrailers. The semitrailers tested in this group are designed for high mileage operation and are generally used for logistical support and line haul operations. This would include tankers and refuelers, and flat bed and van type semitrailers for transporting general cargo.</p>
W9	<p>Trailers and dollies classified as follows:</p> <ul style="list-style-type: none"><li data-bbox="459 789 1443 889">a. Standard types of trailers, semitrailers (except high mileage types), and dollies of all sizes used for general transport purposes.</li><li data-bbox="459 921 1476 1187">b. Trailers with special bodies or equipment mounted on a standard, general-purpose chassis. Ammunition trailers, cargo vans, and tankers are considered in this group. Other vehicles in this category are maintenance and test shops, laboratory and electronic units, office and quarters trailers, expansible vans, and other trailers used primarily to house technical equipment for the support of tactical units rather than for general transport purposes.</li><li data-bbox="459 1219 1476 1315">c. Lightweight, soft-ride trailers specially designed for transporting electronic equipment (including ground-support items for missile systems).</li></ul>



Table 5 - Sample Cyclic Breakdown of Wheeled Vehicle Endurance Test Mileage per Course

Group and Type (Defined in Table 4)	% Primary, Secondary, Cross-Country <sup>a</sup>	Miles <sup>g</sup> per Cycle	No. of Cycles	Total Miles <sup>g</sup>	Water Operation per Cycle
W1 Tactical trucks <sup>b</sup> and armored cars	30-30-40	3,000	8	24,000	15 min. fording or 1 hr. swimming
W2 Truck bodies with tactical support equipment <sup>b c</sup>	60-20-20	3,000	4	12,000	
W3 Lightweight, low mileage trucks: <sup>b</sup> A. Primarily on-road type	60-20-20	1,000	4	4,000	
B. Primarily off-road type	15-25-60	1,000	4	4,000	15 min. fording or
W4 High-flotation vehicles <sup>d</sup>	25-20-55	1,000	4	4,000	1 hr. swimming
W5 Amphibious <sup>b d e</sup>	40-25-35	3,000	3	9,000	60 hr.
W6 Fire trucks: A. Aircraft crash and rescue	49-22-29	2,500	2	5,000	15 min. fording
B. Brush	56-16-28	2,000	2	4,000	15 min. fording
C. Structural	50-50-0	2,000	2	4,000	15 min. fording
W7 Commercial trucks, buses, passen- ger cars	85-15-0	6,000	6	36,000	
W8 Truck-tractors and semitrailers <sup>a</sup>	60-25-15	3,000	8	24,000	15 min. fording
W9 Trailers: A. Trailers and dollies <sup>a f</sup>	34-33-33	1,500	4	6,000	
B. Trailer bodies and equipment	34-33-33	750	4	3,000	
C. Electronic and missile	20-35-45	1,000	4	4,000	

<sup>a</sup>Run 25% of all cross-country mileage under muddy conditions; 50% for trailers, semitrailers, and dollies.

<sup>b</sup>Run last test cycle without payload.

<sup>c</sup>Run tanker pumps 1 hour for each 50 miles of road operation.

<sup>d</sup>Highway operation may be reduced when considered impractical.

<sup>e</sup>During one cycle substitute ocean beach sand with 60 hours operation in salt water for 500 miles of cross-country operation.

<sup>f</sup>Run 50 miles gravel and 50 miles Belgian block without payload at start and completion of this operation. If vehicle has two payloads, run hard surface with highway load and all other courses with cross-country.

<sup>g</sup>For conversion to kilometers, multiply by 1.609.

26 June 1981

Table 6 - Sample Wheeled Vehicle Group Total Endurance Test Mileage per Course<sup>a</sup>

	Vehicle Group													
	W1	W2	W3-A	W3-B	W4	W5b	W6-A	W6-B	W6-C	W7	W8	W9-A	W9-B	W9-C
Primary Roads (Paved Highway)	900	1,800	600	150	250	1,200	1,200	1,125	1,000	5,100	1,800	500	250	200
Secondary Roads:														
Munson Improved Gravel Course	300	225	75	75	75	250	500	300	1,000	600	250	250	125	150
Belgian Block	100	75	25	25	25	100	50	25	-----	50	100	150	75	50
Perryman A Unimproved Gravel	500	300	100	150	100	400	-----	-----	-----	250	200	100	50	150
Churchville C Course <sup>d</sup>	---	---	---	---	---	---	---	---	---	---	200	---	---	---
Cross-Country:														
Level (Perryman Test Area)														
No. 1 Course	350	200	75	100	75	200	375	200	---	---	450	350	125	250
No. 2 Course	100	50	25	75	50	75	---	75	---	---	---	---	---	---
No. 3 Course	100	50	---	50	50	50	---	25	---	---	---	---	---	---
No. 4 Course <sup>c</sup>	50	---	---	25	25	25	25	---	-----	---	---	---	---	---
Hilly (Churchville B Course)	500	225	100	250	200	350	250	200	---	---	---	150	125	200
Swamp	25	---	---	75	100	---	---	---	---	---	---	---	---	---
Sand	75	75	---	25	50	350	100	50	---	---	---	---	---	---
Miles <sup>d</sup> per test cycle	3,000	3,000	1,000	1,000	1,000	3,000	2,500	2,000	2,000	6,000	3,000	1,500	750	1,000
Total test miles <sup>d</sup>	24,000	12,000	4,000	4,000	4,000	9,000	5,000	4,000	4,000	36,000	24,000	6,000	3,000	4,000

<sup>a</sup>The footnotes in table 5 are also applicable.  
<sup>b</sup>For group W5 amphibious vehicles adjust land operation test cycle so vehicle will be operated 1/2 hour at regular intervals to accumulate 60 hours water operation per test cycle.  
<sup>c</sup>For some vehicles the severity of the No. 4 course may exceed the design limits of the vehicle. In this case operate the required mileage on a less severe course.  
<sup>d</sup>To convert to kilometers, multiply by 1.609.

Table 7\*- Wheeled Vehicle Additional Requirements

Group	Requirements
W2	<p data-bbox="448 422 1481 583"><u>Dump bodies:</u> Raise and lower the equivalent of at least once for every 16 kilometers (10 miles), with complete dumping and reloading every fifth cycle. When practicable, this test should be performed during actual dump truck service. Record functioning performance.</p> <p data-bbox="448 621 1481 751"><u>Crane and wrecker trucks:</u> Operate with all accessory equipment properly stowed. Evaluation of the ability of the crane and wrecker to assist in maintenance, supply, and recovery operations is made as follows:</p> <ol data-bbox="480 783 1481 1178" style="list-style-type: none"> <li>Perform simulated or actual lifting operations for 2 hours after each 8 hours of road operation.</li> <li>Perform simulated or actual recovery after each 160 kilometers (100 miles) of road operation.</li> <li>Operate crane at full load using all accessories and with the vehicle repositioned at least four times during each period of lifting operation.</li> <li>Operate the crane and winch simultaneously once during each recovery, if practicable.</li> </ol> <p data-bbox="448 1203 1034 1241"><u>Ambulances, tankers, and cargo vans:</u></p> <ol data-bbox="480 1266 1481 1539" style="list-style-type: none"> <li>Load and unload ambulances once during each 8-hour shift.</li> <li>Load and unload tankers with pumps once for each 320 kilometers (200 test miles). A container must be available to store the unloaded fluid.</li> <li>Load and unload cargo van bodies once for each 800 kilometers (500 miles) of test operation.</li> </ol> <p data-bbox="475 1564 1481 1696">NOTE: Unloading and reloading of vehicle bodies and tanks are time consuming and expensive operations. Limited funds or short-time test schedules necessitate keeping these operations to a minimum.</p> <p data-bbox="448 1728 1481 1892"><u>Heaters, pumps, and other components:</u> Operate as environmental or test conditions require. During extended periods when there is no normal requirement to operate these components, operate long enough to verify operability and the absence of leaks and unusual noises. Document results.</p>

Table 7 (Continued)

Group	Requirements
W6	<p><u>Pumps:</u> Measure capacity at start and conclusion of testing.</p> <p><u>Mounted equipment (ladders, etc.):</u> Operate all types to determine adequacy of operation.</p>
W7	<p>Test to reflect normal service operation such as might be experienced at Army installations. Buses, for example, should make stops at least twice during each mile of test operation.</p>
W9	<p><u>Ammunition trailers:</u> Load and unload once for every 400 kilometers (250 test miles).</p> <p><u>Tankers:</u> Load and unload once for every 320 kilometers (200 test miles). A container must be available to store the unloaded fluid.</p> <p><u>Cargo vans:</u> Load and unload once for every 800 kilometers (500 test miles).</p> <p><u>Electronic and missile system trailers and semitrailers:</u> Subject to the shock and vibration tests described in TOP 2-2-808. When received for testing without an actual payload, simulated loads are installed in accordance with the load diagram furnished by the commodity command project engineer.</p>

TOP 2-2-506

[illegible]

Figure 3. Typical Test Log for Endurance Test of Development Vehicle.

[illegible]

**Figure 4. Typical Operation Summary (Designed for ADP).**

INITIALIZATION DATA SHEET PAGE 1 OF 4																																																															
<div style="display: flex; justify-content: space-between;"> <div> <div style="border: 1px solid black; width: 60px; height: 20px; margin-bottom: 2px;"></div> <div style="display: flex; justify-content: space-between; width: 60px;"> <span>1</span><span>7</span> </div> </div> <div>TEST CODE</div> <div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-bottom: 2px;"></div> <div style="display: flex; justify-content: space-between; width: 40px;"> <span>8</span><span>9</span> </div> </div> <div>           APPROXIMATE NUMBER OF            DURABILITY TEST MILES            (X 10,000 MILES)         </div> <div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-bottom: 2px;"></div> <div style="display: flex; justify-content: space-between; width: 40px;"> <span>79</span><span>80</span> </div> </div> </div>																																																															
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NUMBER OF COURSES (15 MAXIMUM) <div style="border: 1px solid black; height: 20px; margin-top: 5px;"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>1</span><span>2</span><span>3</span><span>5</span><span>7</span><span>9</span><span>11</span><span>13</span><span>15</span><span>17</span><span>19</span><span>21</span><span>23</span><span>25</span><span>27</span><span>29</span><span>31</span> </div>																																																															
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<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">COURSE</th> <th style="width: 35%;">MINIMUM</th> <th style="width: 35%;">MAXIMUM</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td></tr> <tr><td>17</td><td></td><td></td></tr> <tr><td>19</td><td></td><td></td></tr> <tr><td>21</td><td></td><td></td></tr> <tr><td>23</td><td></td><td></td></tr> <tr><td>25</td><td></td><td></td></tr> <tr><td>27</td><td></td><td></td></tr> <tr><td>29</td><td></td><td></td></tr> <tr><td>31</td><td></td><td></td></tr> </tbody> </table>										COURSE	MINIMUM	MAXIMUM	1			2			3			5			7			9			11			13			15			17			19			21			23			25			27			29			31		
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Figure 5. Initialization Data Sheet, p. 1, Summary (for ADP).

INITIALIZATION DATA SHEET PAGE 2 OF 4																
TOTAL TEST MILES REQUIRED IN EACH LOADING CONDITION																
COURSE NUMBER	LOAD 1				LOAD 2				LOAD 3				LOAD 4			
	TOW 1	TOW 2	TOW 3	TOW 4	TOW 1	TOW 2	TOW 3	TOW 4	TOW 1	TOW 2	TOW 3	TOW 4	TOW 1	TOW 2	TOW 3	TOW 4
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	1	6	11	16	21	26	31	36	41	46	51	56	61	66	71	76

Figure 6. Initialization Data Sheet, p. 2, Miles per Loading Condition (for ADP).



26 June 1981

TOP 2-2-506

INITIALIZATION DATA SHEET PAGE 3 OF 4

## VEHICLE INVENTORY

VEH NO. REGISTRATION NUMBER

SERIAL NO./REMARKS

[illegible]

79 80

Figure 7. Initialization Data Sheet, p. 3, Vehicle Inventory (for ADP).

INITIALIZATION DATA SHEET (SUPPLEMENTARY) PAGE 4 OF 4									
USE THIS SECTION TO ENTER TOTAL MILES AND TOTAL OPERATING HOUR VALUES. Also use for total engine hours and total rounds fired.									
TEST CODE									
1	2	3	4	5	6	7			79 80
VEH TOT TEST MILES/TOT OP HOURS/TOT RDS FIRED/TOT ENG HOURS									
.	.	.	.	.	.	.	.	.	.
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1	3	4	13	14	23	24	33	34	43
									I *
USE THIS SECTION TO PLACE FUEL/OIL, MAINTENANCE, AND/OR EPR FILES ON PERMANENT FILE.									
TEST CODE									
1	2	3	4	5	6	7			79 80
FUEL/OIL FILE									
MAINTENANCE FILE									
EPR FILE									
									I *
FOLLOW THESE SECTIONS WITH									
END									

Figure 8. Initialization Data Sheet, p. 4, Miles/Operating Hours, Fuel/Oil, Maintenance/EPR Records (for ADP).